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Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 8731 (1978): Technical supply conditions for general purpose gear hobs [PGD 32: Cutting tools]

“ज्ञान से एक नये भारत का निर्माण”

Satyanaaranay Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartṛhari—Nītiśatakam

“Knowledge is such a treasure which cannot be stolen”





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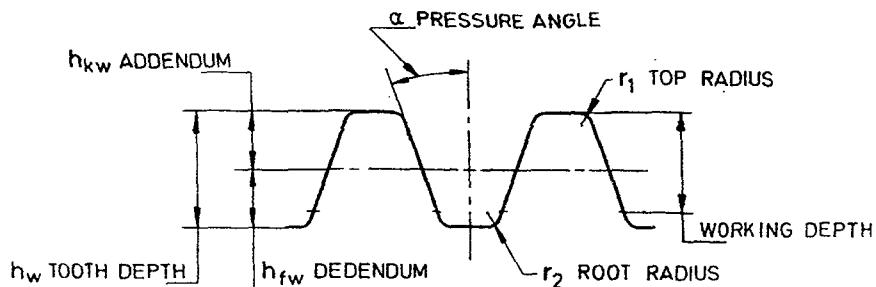


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AMENDMENT NO. 1 JANUARY 2005  
 TO  
 IS 8731 : 1978 TECHNICAL SUPPLY CONDITIONS  
 FOR GENERAL PURPOSE GEAR HOBS

(Page 1, clause 2.1, first sentence) — Substitute 'The hob is a multipoint generating type rotary cutting tool' for 'The hob is a cutter'.

(Page 2, clause 2.3) — Substitute the following figure for the existing first figure:



(Page 3, clause 2.3.20) — Substitute the following for the existing:

'Module — Ratio of pitch diameter of gear to the number of teeth in the gear to be cut with the hob.'

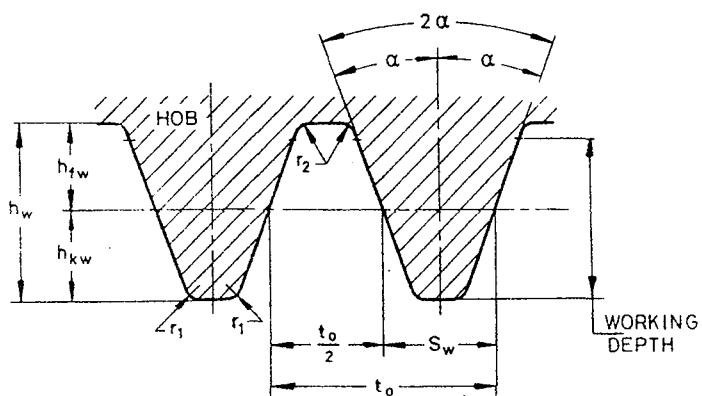
(Page 3, clause 2.3.23) — Add the following after this clause:

'2.3.24 Working depth — The cutting depth on hob tooth which is equal to whole depth of gear tooth.'

Amend No. 1 to IS 8731 : 1978

( Page 4, clause 4 ) — Substitute the following for the existing:

#### 4. Basic Profile of Gear Hobs



$h_{kw}$  = addendum = 1.25 m

$t_o$  = pitch =  $\pi$  m

$h_{fw}$  = dedendum = 1.20 m

$s_w = \frac{t_o}{2}$  = tooth thickness

$h_w$  = tooth depth = 2.45 m

$r_1$  = crest radius  $\approx$  0.2 m

$\alpha$  = pressure angle =  $20^\circ$

$r_2$  = root radius  $\approx$  0.2 m

Working depth = 2.25 m

( BP 11 )

Reprography Unit, BIS, New Delhi, India



Indian Standard

## TECHNICAL SUPPLY CONDITIONS FOR GENERAL PURPOSE GEAR HOBS

**1. Scope** — Covers the terminology, material and other requirements for single start gear hobs for general purpose spur, helical and worm gears with involute teeth.

### 2. Terminology

**2.1 Hob** — The hob is a cutter, cylindrical in shape and resembles a worm in appearance having teeth, created by numbers of gashes on its periphery following a helical path like a worm thread. In hobbing method both the hob and the gear revolves continuously in timed relation, the teeth being generated by a hob as it gradually feeds across or into the work blank.

**2.2 Types of Gear Hobs** — Shall be as shown in Fig. 1 to 4.

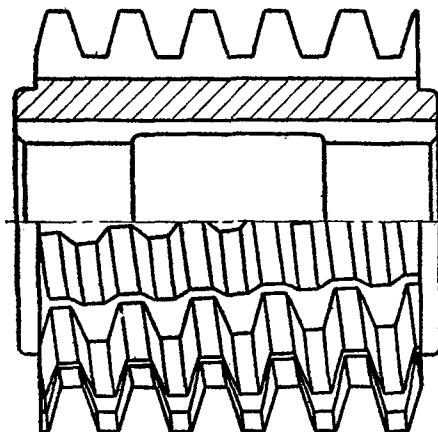


FIG. 1 GEAR HOB WITH KEY DRIVE

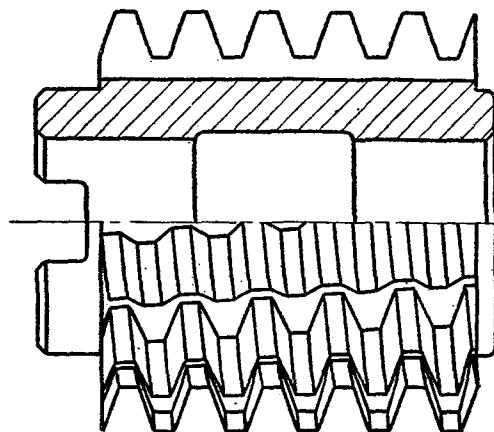
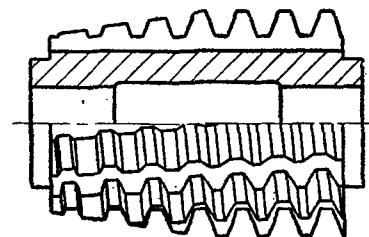
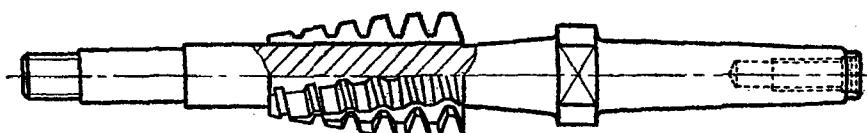
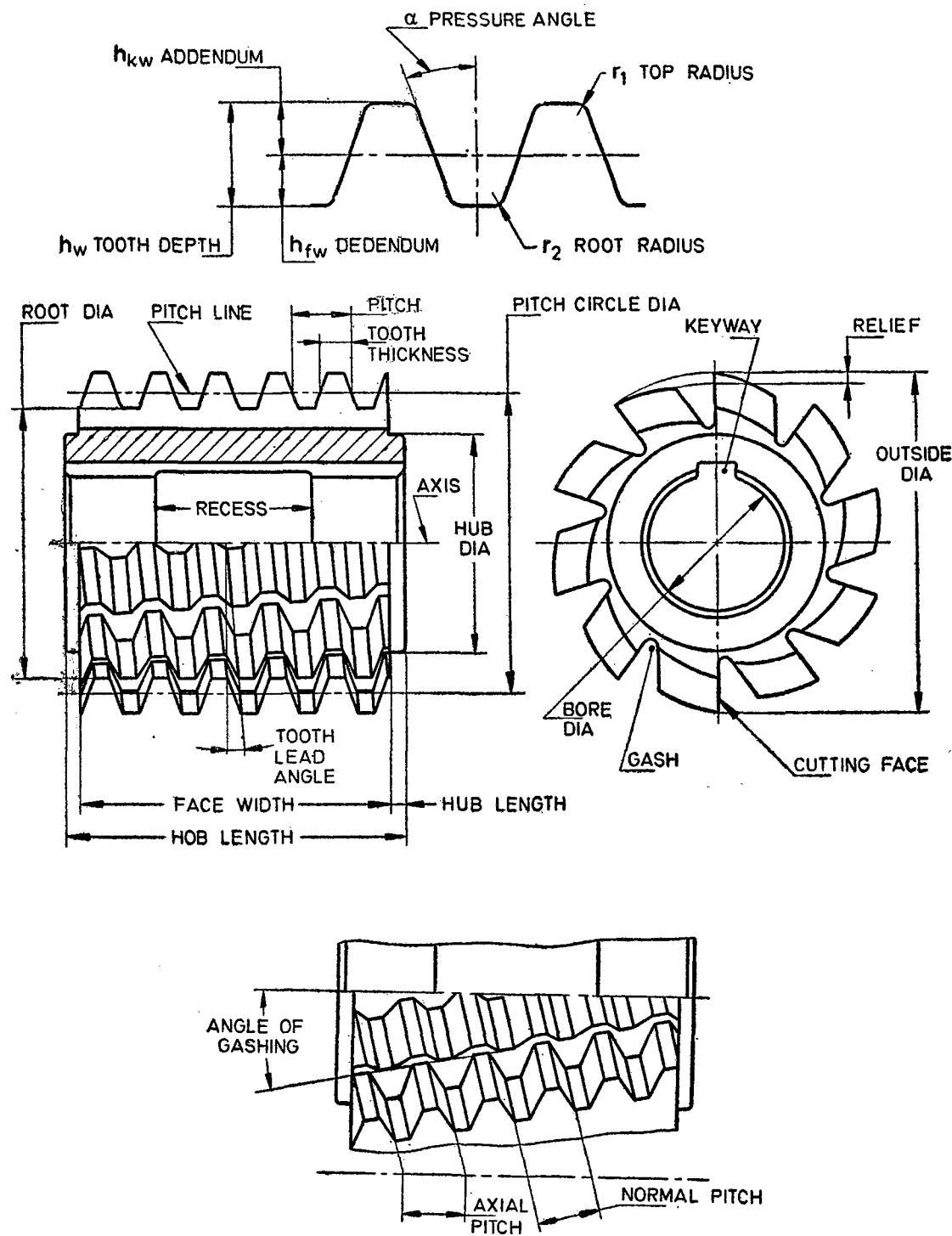


FIG. 2 GEAR HOB WITH CROSS SLOT DRIVE

FIG. 3 BORE TYPE WORM GEAR HOB  
(TANGENTIAL FEED)FIG. 4 SHANK TYPE WORM GEAR HOB  
(TANGENTIAL FEED)

**2.3 Elements of Gear Hobs — Shall be as shown below:**



**2.3.1 Axis** — The longitudinal centre line of the hob.

**2.3.2 Pressure angle** — The angle subtended by the flank of hob tooth and an imaginary radial line normal to axis of hob, in an axial plane.

**2.3.3 Tooth lead angle** — The angle subtended by the tooth helix with a plane normal to axis of the hob.

**2.3.4 Angle of gashing** — The angle subtended between the leading edge (cutting edge) and the hob axis.

**2.3.5 Outside diameter** — On a hob having a parallel profile, the outside diameter is the diametral measurement over the crest of the teeth of the cutting edge, also the maximum diameter of the hob.

**2.3.6 Pitch circle diameter** — On a hob having parallel profile, the pitch circle diameter is the diameter of an imaginary co-axial cylinder which would pass through the profile at such points as to make the width of the tooth and tooth space equal.

**2.3.7 Hub diameter** — The diametral measurement of the hub.

**2.3.8 Root diameter** — Diametral measurement of the root of teeth.

**2.3.9 Bore diameter** — Diametral measurement of the bore of a hob.

**2.3.10 Hob length** — The axial length over the extreme ends of the hob.

**2.3.11 Pitch line** — In a hob having parallel profile, the pitch line is an imaginary line which would pass through points as to make the width of the tooth and tooth space equal.

**2.3.12 Hub length** — The axial length of the hub.

**2.3.13 Pitch** — The distance between corresponding points on adjacent teeth.

**2.3.14 Axial pitch** — The distance measured parallel to its axis, between corresponding points on adjacent teeth in the same axial plane.

**2.3.15 Normal pitch** — The distance measured normal to lead angle, between corresponding points on adjacent teeth on a plane normal to helix.

**2.3.16 Tooth thickness (at pitch line)** — The length of the chord subtended by the circular thickness at pitch diameter.

**2.3.17 Hob addendum** — Height of the tooth above pitch circle or the radial distance between the pitch circle and the top of the tooth.

**2.3.18 Hob dedendum** — The depth of the tooth space below the pitch circle or the radial dimension between the pitch circle and the bottom of the tooth space.

**2.3.19 Tooth depth** — The total depth of a tooth space, equal to addendum plus dedendum, also equal to working depth plus clearance.

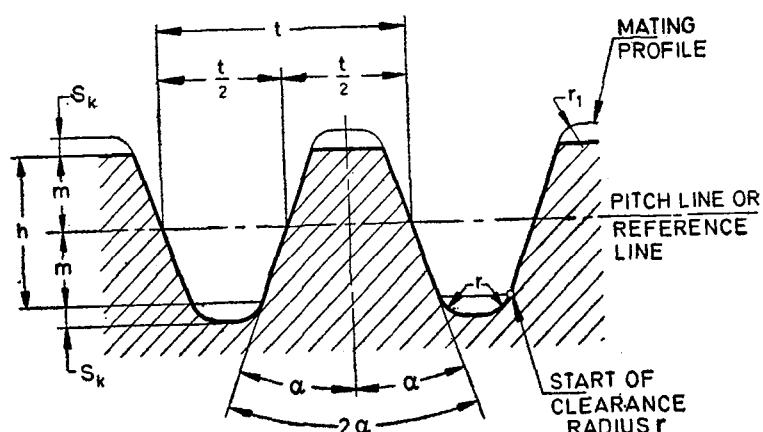
**2.3.20 Module** — Ratio of pitch diameter to the number of teeth.

**2.3.21 Cutting face** — The face which actually cuts in operation.

**2.3.22 Straight gashing** — The gashing of tooth parallel to the axis.

**2.3.23 Helical gashing** — The gashing of tooth at an angle to the axis.

### 3. Profile of Basic Rack of Gears ( Modules 1 to 20 )



$m$  = addendum = module

$t$  = circular pitch =  $\pi m$

$\frac{t}{2}$  = tooth thickness

$\alpha$  = pressure angle =  $20^\circ$

$2\alpha$  = flank angle =  $40^\circ$

$h$  = working depth =  $2m$

$S_k$  = clearance =  $0.1m$  to  $0.3m$

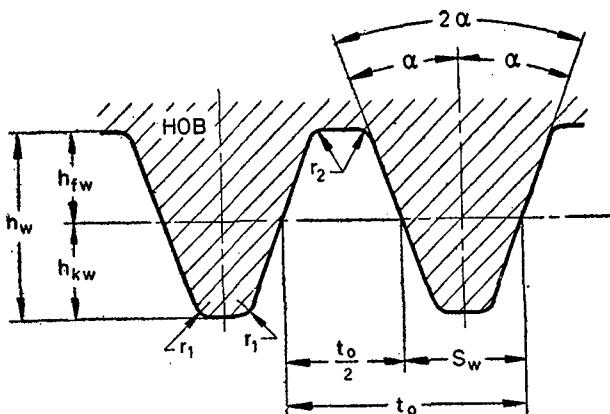
$r$  = root radius =  $0.4m$  Max

$r_1$  = rounding of tooth =  $0.2m$

Dedendum =  $m + S_k$

Full depth =  $h + S_k$

## 4. Basic Profile of Gear Hobs



$$h_{kw} = \text{addendum} = 1.25 \text{ m}$$

$$t_0 = \text{pitch} = \pi m$$

$$h_{fw} = \text{dedendum} = 1.20 \text{ m}$$

$$s_w = \frac{t_0}{2} = \text{tooth thickness}$$

$$h_w = \text{tooth depth} = 2.45 \text{ m}$$

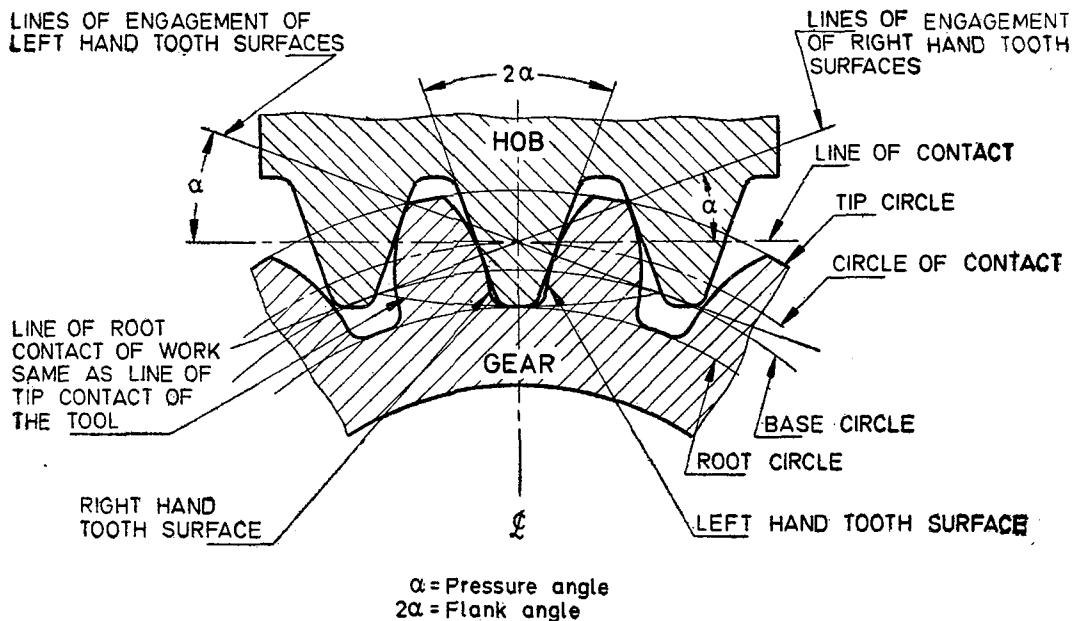
$$r_1 = \text{crest radius} \approx 0.2 \text{ m}$$

$$\alpha = \text{pressure angle} = 20^\circ$$

$$r_2 = \text{root radius} \approx 0.2 \text{ m}$$

where  $m = \text{module}$

## 5. Hob and Gear



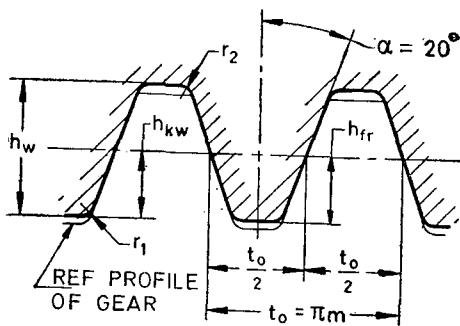
## 6. Reference Profile of Gear Cutting Tools

The basic rack of gear tool is the profile, by which a toothform corresponding to 3 is produced.

The outside diameter of the gear is not generally machined by the gear cutting tool, the tooth thickness depends on the requirements of the technological operation. The modification of tooth profile is optional.

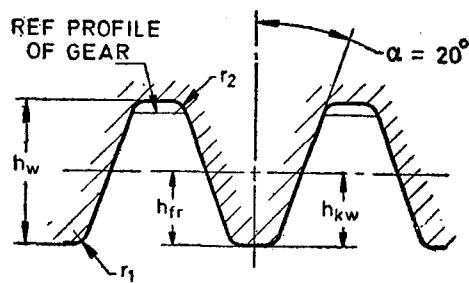
The addendum is given for the Profiles I, II, III and IV (see 6.1) which may be selected, suiting the work to be done.

Reference profiles of tools shall be as given below:



**Profile I**  
(for Finishing)

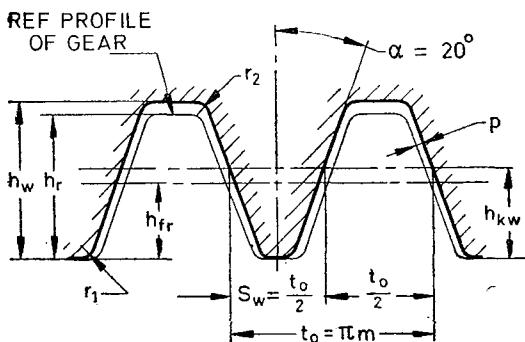
$$\begin{aligned} h_{kw} &= h_{fr} = 1.167 \text{ m} \\ h_w &\geq 2.367 \text{ m} \\ r_1 &= r_2 \approx 0.2 \text{ m} \end{aligned}$$



**Profile II**  
(for Finishing)

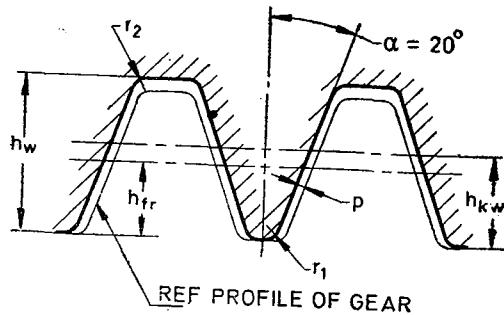
$$\begin{aligned} h_{kw} &= h_{fr} = 1.25 \text{ m} \\ h_w &\geq 2.45 \text{ m} \\ r_1 &= r_2 \approx 0.2 \text{ m} \end{aligned}$$

where  $m$  = module



**Profile III**  
(for Roughing Prior to  
Grinding or Shaving)

$$\begin{aligned} h_{kw} &= 1.25 \text{ m} + 0.25 \sqrt[3]{m} \\ h_{fr} &= 1.25 \text{ m} \\ h_w &\geq 2.45 \text{ m} \\ r_1 &= r_2 \approx 0.2 \text{ m} \\ p &= (h_{kw} - h_{fr}) \sin \alpha \\ &= 0.25 \sqrt[3]{m} \sin \alpha \\ h_r &= \text{full tooth depth} \end{aligned}$$



**Profile IV**  
(for Roughing Prior to  
Finishing)

$$\begin{aligned} h_{kw} &= 1.25 \text{ m} + 0.6 \sqrt[3]{m} \\ h_{fr} &= 1.25 \text{ m} \\ h_w &\geq 2.45 \text{ m} \\ r_1 &= r_2 \approx 0.2 \text{ m} \\ p &= (h_{kw} - h_{fr}) \sin \alpha \\ &= 0.6 \sqrt[3]{m} \sin \alpha \end{aligned}$$

where  $m$  = module.

#### 6.1 Application for Profiles I, II, III and IV

**Profile I** — Intended for finishing tools, for example, gear hobs, rack type shapers, gear tooth-space form milling cutters. When the gear teeth are roughed out by a tool with profile III or IV, the finishing tool with profile I will not touch the root circle of the gear. Profile I can be further applied when a small allowance is to be produced, for example, before shaving.

**Profile II** — Intended for finishing tools, for example, for gear-shaper cutters. It may be applied for hobs also, if on the root of gear teeth fillets of large radius are to be generated.

**Profile III** — Intended for tools by which the teeth are roughed only, for instance with an allowance for grinding. In this case the gear cutting machine is to be adjusted for cutting the full tooth depth 'hr' on the gear blank. When a smaller amount of allowance is required than that defined by the profile III, the gear cutting machine must be adjusted to cut a larger tooth depth. The dedendum of the gear 'h<sub>fr</sub>' will be greater than 1.25 m in this case.

**Profile IV** — Intended for roughing the gear tooth only for instance with an allowance for milling or shaping. The tooth thickness may be varied by variation of the tooth depth, for instance if backlash is required.

**6.1.1 Tooth thickness allowance** — The tooth thickness allowance applied, for example, in order to impart backlash, can be obtained by varying the depth setting of the gear-cutting machine.

**6.1.2 Tooth profile modifications** — It is undertaken for the purpose of securing better profile entry configurations (for example, through larger radiusing at the base of the teeth), or for the purpose of relieving the dedendum of the gear to obtain easier finishing of shaving (by giving the addendum more thickness) are not standardized. Cutters of these types count as special designs and are subject to agreement between the customer and the tool supplier.

## 7. Material

a) One piece construction	High speed steel
b) Two piece construction:	
Cutting portion	High speed steel
Shank portion	Carbon steel with tensile strength not less than 700 Mpa* (before construction)

**Note** — The type of high speed steel shall be mentioned by the purchaser, while ordering.

## 8. Hardness — 760 HV to 900 HV.

**Note** — Shank portion, in case of two piece construction shall be suitably heat-treated so as to produce no defect.

## 9. General Requirements

**9.1** Accuracy grade and tolerances for gear hobs shall be according to IS : 8733-1978 'Tolerances for single start gear hobs'.

**9.2** Unless otherwise specified the gear hobs shall be supplied right-hand cutting, single start having basic Profile II.

**9.3** All sharp corners except cutting edges shall be removed.

**9.4** Incomplete teeth shall be rounded off.

## 10. Packing

**10.1** Each gear hob shall be covered with a suitable rust-proof coating and packed in a non-absorbent paper.

**10.2** Each gear hob as treated in **10.1** shall be packed in a carton, bearing the type, nominal size, material and the manufacturer's name, initials or trade-mark.

## 11. Marking — Hobs shall be marked with the following:

- a) Module;
- b) Pressure angle;
- c) Grade;
- d) Setting angle for hobbing;
- e) Gash lead;
- f) Hand (right hand or left hand);
- g) Tooth profile;
- h) Profile correction, if any;
- j) Working depth;
- k) Material; and
- m) Trade-mark.

\*1 Mpa = 0.1 kgf/mm<sup>2</sup> (approx).

## EXPLANATORY NOTE

In the preparation of this standard considerable assistance has been derived from the following publications:

DIN 867-1963 Bezugsprofile fur Stirnrader mit Evolventenverzahnung fur den allgemeinen Maschinenbau ( Basic rack for spur gears with involute teeth for general engineering ).

DIN 3972-1952 Bezugsprofile von Verzahnwerkzeugen fur Evolventen-Verzahnungen nach DIN 867. ( Reference profiles of gear-cutting tools for involute tooth systems to DIN 867 ).

This standard is one of a series of Indian Standards on gear hobs. The other standards published so far in this series are:

IS : 8732-1978 Single start gear hobs with axial keyway

IS : 8733-1978 Tolerances for single start gear hobs